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DEPARTMENT OF METHODS, REVIEWS, ABSTRACTS, AND BRIEFER ARTICLES

REMARKS ON THE LIFE-HISTORY AND THE SCALE CHARACTERS OF AMERICAN MULLET

BY

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Mr. Arthur Paul Jacot, in the July issue of these TRANSACTIONS for 1920 (pp. 199-229), has presented the results of his investigations on scales of two American mullets: *Mugil cephalus* and *M. curema*. He has discovered a number of facts bearing significantly upon problems in several of the zoological sub-sciences. These facts, and, more particularly the author's interpretations of them, are discussed in this brief note.

Mr. Jacot's discovery that the scales of these species of *Mugil* are ctenoid proves an unexpected confirmation of the view recently held by Jordan and Hubbs¹ that the group Percosoces, comprising the Mugilidae and related families, is derived from the typical Acanthopterygii (which is characterized in part by ctenoid scales), and hence is not transitional between the cycloid-scaled malacopterygian fishes and the more specialized spiny-rayed types. The wide differences found in the character of the ctenii on the scales of the species of *Mugil* studied are also of considerable taxonomic interest.

The detailed account given of the development of scale structure, and the final proof of the transformation of the first soft-ray of the anal fin of the juvenile or Querimana stage into the third anal spine of the adult *Mugil*, are valuable contributions from the standpoint of the comparative anatomy of these structures. This juvenile metamorphosis of *Mugil* has long been in need of the detailed study which Mr. Jacot has accorded it.

The sharply defined mark on the scales of *Mugil cephalus*, which the author appears to have interpreted as a metamorphic annulus, is obviously the first winter annulus; apparently intensified, it is true, by the fact the adult characters appear first in the spring, synchronously with the resumption of the growth of the scale and of the fish, following the cessation of growth significantly demonstrated to occur during the winter. The portion of the scale within this first winter annulus therefore corresponds with the

¹ A monographic review of the family of Atherinidae or Silversides (Stanford Univ. Publ.), 1919.

brief period of initial growth² between hatching and winter. The similarity existing between the first annulus developed on the scales of *Mugil curema* to that of *M. cephalus* indicates that this species likewise breeds in the fall, rather than during the summer as Jacot supposed.

This altered conception of the nature of the first annulus involves a different interpretation of the age at maturity of *Mugil cephalus*: the first spawning fish appear to be just two years old (rather than in their second year); similarly, the oldest individual examined was six years old.

The second and succeeding line-like annuli developed on the scales of these species of *Mugil* being typical of the winter marks developed on the scales of marine fishes of temperate waters, and of the coregonine fishes of the Great Lakes, it is, to say the least, unnecessary to follow Jacot in interpreting these marks as migratory rather than as winter annuli. The fact that an annulus was not evident near the margin of scales of mullets taken at Beaufort in early spring indicates merely that the spring growth of these fishes had not yet commenced, and not that these fishes were exceptional non-migratory individuals. Indeed, it is not at all certain that the mullets actually do migrate southward during the winter, for a growing body of evidence is indicating that in this season many shore-fishes of the Temperate Zone merely retreat into deeper water and become less active, and hence appear absent because not caught.

These altered interpretations bring Mr. Jacot's facts into much better agreement with the results of studies made on the life-history of other fishes, and in the opinion of the writer, enhance the value of his contributions.

Mr. Jacot has introduced some new terms, none of which will probably be adopted. Of these "adulthood (changing to the adult condition)" and "circulation" (referring to the course of the circuli on the scales), require no further comment. The term "linea (from the Latin *linea*, ae, f.; using the term in its more figurative expression)," is unnecessarily substituted for *annulus* or "winter band"; a similar statement might be applied to "ctenobasii."

² It is probable that the juvenile mullets pass during this period through a pelagic stage, for which the Querimana characters are well adapted. *Labidesthes sicculus*, a fresh-water fish related to *Mugil*, passes through such an initial pelagic stage.